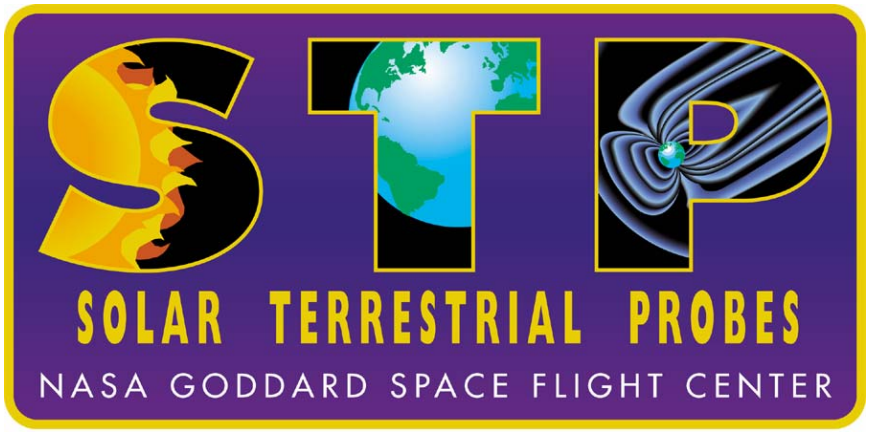
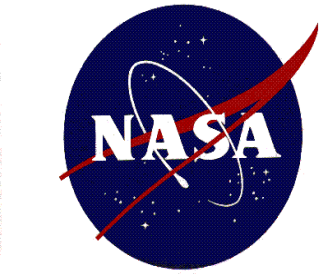
SOLAR TERRESTRIAL PROBES PROGRAM PLAN



MARCH 2001



GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

CHANGE LOG

Revision Ltr/Change No.	Date Submitted	Submitted By	Description/Pages Effected	Date Approved
Original Release	3/2001	G. Colón	All (This Plan cancels 460-PG-7120.1.1)	6/25/01

SOLAR TERRESTRIAL PROBES PROGRAM PLAN

APPROVED BY:

Gilberto Colón STP Program Manager	Date
A. V. Diaz Director, Goddard Space Flight Center	Date
Dr. Edward J. Weiler Associate Administrator for Space Science	Date

TABLE OF CONTENTS

List of Figures

List of Tables

1.0 Introduction and Program Overview

1.1. Introduction

The Solar Terrestrial Probes (STP) Program supports the Sun-Earth Connection (SEC) goal of understanding our changing Sun and its effects on the solar system, life and society. STP is funded and managed by the Office of Space Science (OSS). Specifically, the science missions in the STP Program obtain information to respond to two quests or goals in the SEC science road map:

1. How and why does the Sun vary?
2. How do the Earth and planets respond?

STP Projects are defined by the coordination between the OSS and the SEC community and are documented in the SEC Roadmap, a document that is subordinate to the Space Science Enterprise Strategic Plan. All SEC goals are traceable to the NASA Strategic Plan and the Space Science Strategic Plan.

Seven projects, or missions, have currently been defined in the STP Program and are listed in Table 1. Only three of these missions, the Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED), Solar-B, and the Triana Plasma-Mag instrument suite are in Implementation. TIMED was originally approved as a Program, but is now considered to be a project under the STP Program. It is expected that STP will be an on-going program, with definition of the sequence and content of additional missions being based upon the SEC Strategic Plan.

1.2. Overview

This document describes for the STP Program:

a. objectives and performance goals
b. program-level requirements and processes
c. acquisition strategy
d. management organizations responsible for the program
e. resources, schedules, and controls
f. other requirements and processes that have been tailored for the STP Program with supporting rationale in reference to NPG-7120.5A.

2.0 Program Objectives and Performance Goals

The STP Program Objectives are directly tied to the quests in the SEC theme. The objectives are:

1. To describe the system behavior of the magnetic variable star, our Sun, and its interaction with the entire solar system;
2. To understand the critical physics that link the Sun, Earth, and the interstellar medium; and
3. To understand the processes and dynamics of geospace, the Earth's space environment.

These Program Objectives will be accomplished by using streamlined and innovative management techniques and new technologies to implement the projects within the commitments established by the Office of Space Sciences (OSS). The STP Program implements a series of complimentary projects, which fulfill the STP Program Science Objectives. The STP Projects are strategic elements of the Sun-Earth Connection Theme and are designed for the sustained study of critical aspects of the Sun-Earth system. All STP Projects address focused science objectives.

The following are the projects defined to date.

1. TIMED (which was approved by the AA and is currently in implementation);
2. Solar-B (an international mission similar to SOHO where the U.S. provides scientific instruments);
3. Solar Terrestrial Relations Observatory (STEREO);
4. Triana Plasma-Mag Instrument Suite (the STP Program shall provide an instrument for this project which is part of the Earth Probes-G Program);
5. Magnetospheric MultiScale (MMS);
6. Global Electrodynamic Connections (GEC); and
7. Magnetospheric Constellation (MC).

With the exception of TIMED, Triana and Solar-B (which is a major Japanese mission that is a follow-on to YOHKOH), these STP Projects are multi-spacecraft missions ranging from two spacecraft (STEREO), four to six (GEC and MMS) Small Explorer class spacecraft or multiple (50-100 or more) nano-satellites (MC).

Project	Area of Investigation	Responsiveness:	
		No. of Quest	No. of Objective
Thermosphere – Ionosphere – Mesosphere Energetics and Dynamics (TIMED)	Measure the energy budget of the Earth's mesosphere and lower thermosphere and use the data for improving understanding of this atmospheric region and to provide a baseline for global change research.	2	1,2,3
Solar B	Measure the Sun's magnetic field and ultraviolet/X-ray radiation and use the data to increase the understanding of the sources of solar variability.	1	1,2
Solar Terrestrial Relations Observatory (STEREO)	Make three-dimensional observations coronal mass ejections from their solar origins out into the heliosphere for improved understanding of the physics and for improved reliability of space weather forecasts and warnings.	1	1,2
Triana Plasma-Mag	Measure the solar wind and solar magnetic field and use the data to provide an early warning of solar disturbances for space weather applications on Earth.	2	1
Magnetospheric MultiScale (MMS)	Make multipoint measurements of the Earth's magnetospheric plasma and use the data for improving understanding of magnetic reconnection, plasma turbulence, and energetic particle acceleration.	2	1,2
Global Electrodynamic Connections (GEC)	Measure the neutral and plasma components near the boundary of the magnetosphere and ionosphere and use the data to identify the spatial and temporal scales governing the exchange of electromagnetic energy between the two regions.	2	1,2,3
Magnetospheric Constellation (MC)	Measure the three-dimensional variations in the Earth's plasma and fields and use the data to identify how geomagnetic storms are generated and to test theoretical models for these phenomena.	2	1,2

Table 1 Solar Terrestrial Probe Program / Project Science Goals

3.0 Customer Definition and Advocacy

3.1. Customer Definition

The STP Program customer base is centered in the space science community representing the SEC theme.

3.2. Customer Advocacy

The STP Program customer advocacy is achieved through interactions between the OSS and the science community. These interactions involve the OSS scientific advisory committees as well as day-to-day contacts by the program scientists and discipline scientists resident in the OSS Research Program Management Division.

The GSFC STP Lead Scientist (LS) provides a scientific interface between the STP Program Manager and the SEC community and the NASA Headquarters STP Program Scientist(s). The LS is the

technical advisor to the STP Program Office and provides scientific evaluations and assessments of the STP Projects.

Contact between the STP Program Office and the science community is through SEC Advisory subcommittee meetings, Announcement of Opportunity (AO) pre-proposal conferences, scientific meetings, technology showcases and periodic workshops to solicit feedback on program processes. The SEC Theme Program Integration Manager in the GSFC Associate Director's Office will support the interface with OSS and the integration of the STP Program and Projects into the SEC Theme.

4.0 Program Authority and Management Structure

4.1. Authority

Program authority has been delegated by the Space Science Enterprise (SSE) Associate Administrator (AA) through the GSFC, as the lead center for the STP Program, to the STP Program Manager within the Flight Projects Directorate at GSFC (see Figure 1). The GSFC Program Management Council (PMC) is the governing PMC for the STP Program.

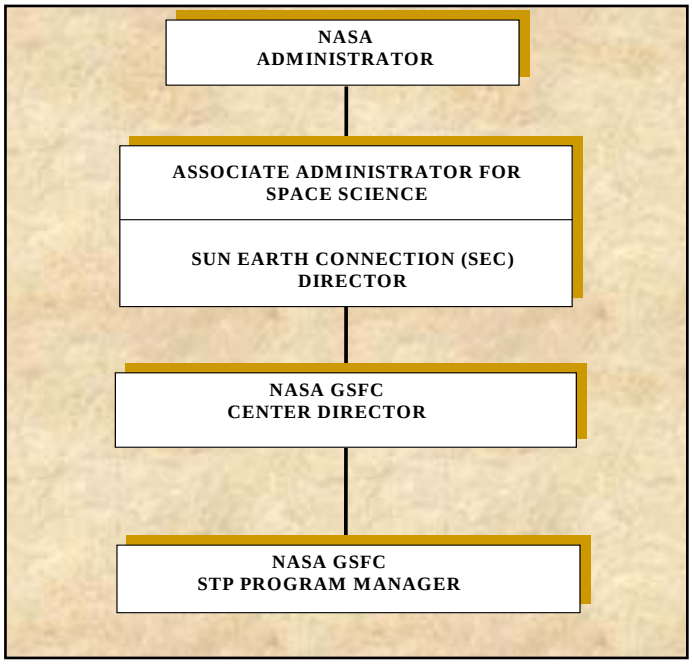


Figure 1 Overview of the NASA Organization for the STP Program

4.2. Responsibilities

4.2.1. NASA Headquarters

In accordance with the NASA Strategic Management Handbook (NPG 1000.2, January 2000), NASA Headquarters Office of Space Science (OSS) has the responsibility for establishing overall STP Program policy, soliciting and selecting missions, establishing the Program and science objectives, requirements and priorities, allocating the Program budget guidelines, and assessing Program performance. OSS is responsible for formulating the elements, structure, and content of Programs and for defining the Project Level 1 Requirements. OSS develops and maintains the STP Program Commitment Agreement (PCA). NASA Headquarters also has the responsibility for establishing the formal agreements with other

U.S. Government organizations and with foreign space organizations and institutions. The Space Science Enterprise AA (ESE AA) has delegated the above programmatic responsibility for the STP Program to the Flight Programs Division (Code SD) for the development and launch of space missions, the Research Program Management Division (Code SR) for scientific responsibility, and the SEC Science Director for overall SEC policy and management.

4.2.2 Lead Center

The Space Science Enterprise AA (SSE AA) has assigned GSFC to be the Lead Center for the STP Program. The GSFC Center Director is responsible for overall Program success and is accountable to the SSE AA. The GSFC Center Director holds the STP Program Manager accountable for directing a program, which meets Agency, Center, and STP Program requirements within established cost, schedule, and performance boundaries. The GSFC Center Director shall certify the flight readiness of each STP Project to the AA for Space Science.

If another NASA center is designated as the implementing center for a project, the center and project management shall formulate roles and responsibilities that are compliant to their internal procedures. The project plan shall document these roles and responsibilities, be compliant with the STP Program Plan, and be compliant to the respective center's internal procedures.

4.2.3. Program Office

The STP Program Manager is responsible for the total range of program activities from support to NASA Headquarters during Program Formulation through Project Implementation and on-orbit checkout. The STP Program Manager is responsible for the program cost, schedule, technical performance and the management system throughout the life of the program, as well as defining metrics for assessment of program formulation and implementation performance. The Program Office develops the integrated budgetary requirements and schedule based on OSS budgetary guidelines for the STP Program and recommends the Program content to Headquarters for approval. The STP Program Office defines the content and schedules consistent with the STP PCA and Program Operating Plan (POP) agreements. Resource requirements for each project from Formulation through Implementation are defined to include funding, manpower, facilities, technical and institutional support, launch facilities, and other resources such as tracking and data capabilities and services which make project success possible. Program risks and internal agreements are included as well.

The Program Office establishes operational policies for the STP Program, ensures appropriate independent review of STP Projects (in coordination with STP Program Executive), monitors the progress of each project, reports project and program status to GSFC and NASA management, recommends necessary corrective and preventative actions. The Program Office is responsible for ensuring that each STP Project stays within the committed cost, schedule, performance, reliability, and safety requirements. The Program Office promotes efficiencies through the application of innovative management practices, the identification and implementation of inter-project synergies, and the capture and application of lessons learned. The Program Office supports OSS in the preparation of STP Program Announcement of Opportunities (AO's), NASA Research Announcements (NRA's), and NASA interagency and international agreements associated with STP Projects. The Program Office manages the STP Technology Program and coordinates E&PO efforts for the STP Projects. For projects that are GSFC led, the GSFC Center Director shall appoint a Project Manager who is responsible for the above actions for each project. Similarly, for projects led by other NASA centers, the respective center director shall appoint the project manager.

4.3. STP Program Office Organization

The STP Program Office shall be located within the Flight Programs and Projects Directorate (FPPD) at GSFC. The STP Program Office Organization is depicted in **Figure 2**. The Program Office shall provide a shared resources team for all projects and program management. The Program Office is structured to provide a small, core program office staff and short lines of communication between the STP Program scientists, STP Project and Formulation Managers and the STP Program Manager. All STP Project Managers shall report programmatically to the STP Program Manager. However, a Project Manager for a given STP Project may reside administratively outside of the STP Program Office (i.e., Solar-B's Project Manager is from NASA Marshall Space Flight Center (MSFC)). All project resources, both programmatic and institutional, shall be budgeted and accounted for through the STP Program Office. Reporting for all STP Projects shall be through the STP Program Office.

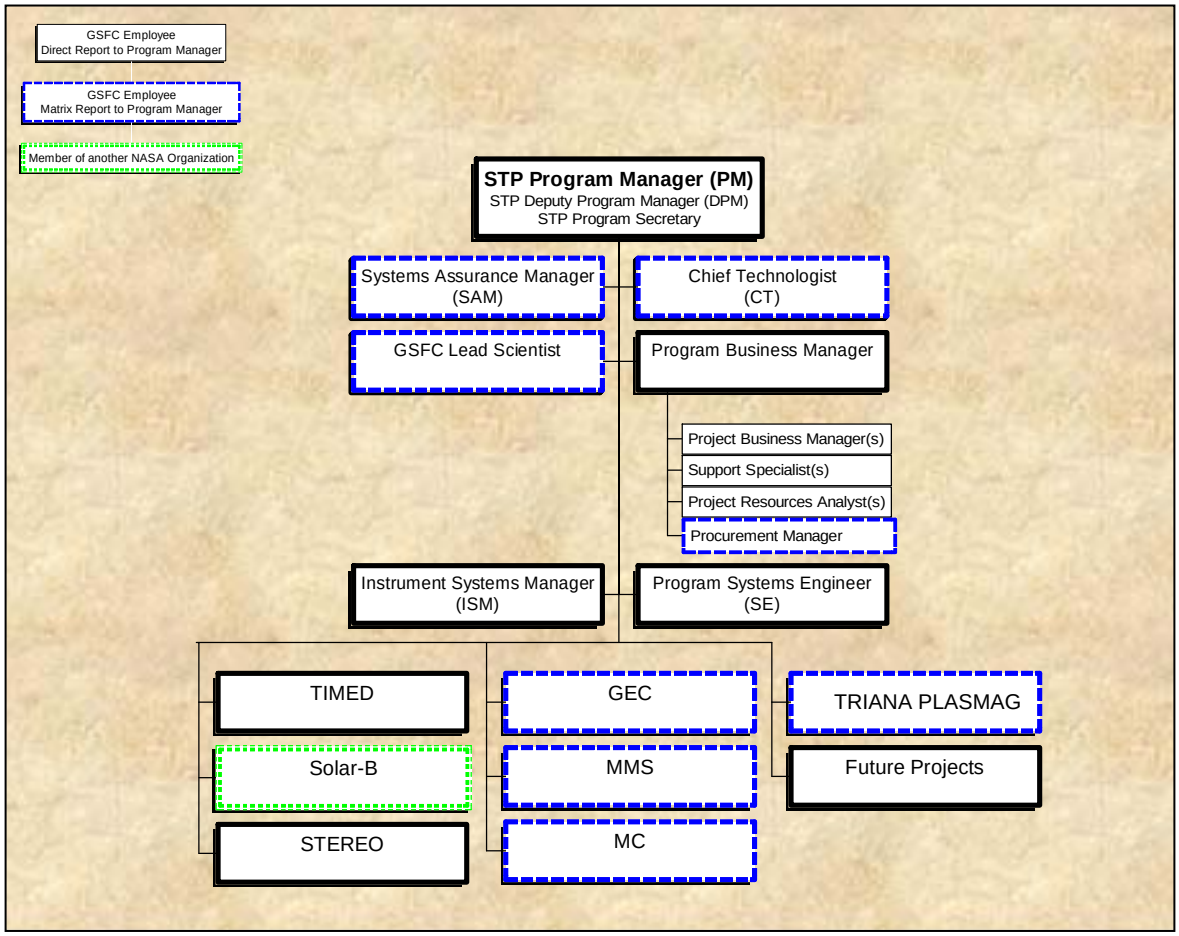


Figure 2 STP Program Organization Chart

4.4. Program Reporting Requirements

The STP Program is required to report to senior NASA management in the forums listed in **Table 2.** Special discussion topics - as detailed in this Program Plan - shall be included in these forums: i.e., Risk Management, Budgets, Program Master Schedule, etc.

Forum	***Report***	***Schedule***
Goddard Space Flight Center PMC	Technical Progress, Cost, Schedule	Monthly
GSFC POP	Technical Progress, Cost, Schedule	Twice a Year
OSS Weekly Status Reports	Electronic Weekly Progress Report	Weekly, after CDR

Table 2 Reporting Forums for the STP Program

OSS will participate in the Goddard Space Flight Center (GSFC) PMC Reviews in lieu of separate presentations to NASA Headquarters. In addition, the STP Program Office will electronically transmit copies of the GSFC PMC report to the designated OSS monthly report web site. Electronic weekly progress reports are required for all projects that have passed the CDR milestone.

4.5. Program Flexibility

It is recognized that the STP Program structure and processes will change over time in response to the needs of the OSS, SEC, and the science community. SSE will authorize the addition of new projects in support of the Sun-Earth Connection roadmap. The STP Program Office will work with OSS to define and implement appropriate changes to the program. These changes will be formalized by changes to this document.

5.0 Program Requirements

5.1. Program Level Requirements for Projects

A Formulation Authorization Document (FAD), approved by the SSE AA and/or SEC Science Director, shall be required for all new projects in order to enter Phase A of Formulation. The FAD identifies the purpose of the project, scope of work to be accomplished in formulation, and any constraints. The signed FAD will be sent to the GSFC Center Director and the STP Program Manager under cover of a project authorization letter issued by the SSE AA authorizing Phase A to begin. A minimum of one quest and one objective in the Sun Earth Connection Roadmap will be addressed in each STP mission.
A draft Program-Level Requirements Appendix to this Program Plan shall be prepared early in the Formulation sub-process (Phase A/B) for each new project. These requirements will be refined and modified as necessary during formulation and finalized when the project receives approval from the SSE AA to proceed to Implementation. After SSE AA approval, the Program-Level Requirements will be placed in Appendix A of this document. Required approvals include the STP Program Manager, GSFC Center Director, SEC Science Director, STP Program Executive, and the SSE AA.

For the TIMED Project, Level 1 Requirements will be appended as the Program-Level Requirements Appendix. Program Plans and Program-Level Requirements Appendices are generally not revised after approval. However, if necessary, modifications may be made and documented in a revision to the Program Plan and Program-Level Requirements Appendices, if approved by the SEC Science Director and the SSE AA.

5.1.1. Program-Level Requirements Appendix Content

The Program-Level Requirements Appendix shall identify the top level mission, science and programmatic requirements (funding and schedule) imposed on the project. It covers project-unique policies, and specifies requirements on science data collection, mission and spacecraft performance, budget, schedule, launch vehicle, data management plan, and any other program requirements. Emphasis is placed on mission unique requirements and should not repeat the program-level requirements already contained in this Program Plan. Each Program-Level Requirements Appendix, shall define both the baseline (full success) and the minimum science requirements based on the selected proposal and according to the following definitions:

- Full Success Requirements – That mission which, if fully implemented, will accomplish the entire set of scientific objectives identified at time of project approval.
- Minimum Success Requirements – The minimum science component success criteria below which the project will not be considered successful for the proposed cost.

The Appendix shall also delineate which requirements constitute the Baseline (full success) Mission Success Criteria and which constitute the Minimum Mission Success Criteria.

5.1.2. Cost, Schedules and Technical Performance

Costs, schedules and technical performance requirements (i.e., Program Level Requirements (PLR's) shall all be approved and baselined at the time of project approval to transition into implementation. The cost and schedule baselines shall encompass the entire project life, including implementation, launch, operations, and data analysis and archiving (NASA program management costs are not included). During formulation, schedule and cost contingency levels shall be monitored and reported at

each of the confirmation reviews (Phase A to B and Phase B to C). Contingency levels shall be demonstrated to be commensurate with the level of risk in the project.

After the project is approved for implementation, both schedule slack and cost contingency levels shall be monitored and reported monthly in the GSFC PMC as back-up charts. A Termination Review may be called at any time during the implementation of a project if the estimated cost growth or schedule slippage exceeds the limits established in the PCA. Similarly, a Termination Review may be called if the estimated technical performance is reduced beyond the limits defined in the PCA. Should either of these two events occur, the GSFC Director of Flight Programs and Projects will consult with the Headquarters Sun-Earth Connection Theme Director as to the need for a Termination Review. Cost or schedule increases that are completely beyond the control of the Project Manager and project may be an exception to the need for a Termination Review. These increases could result in an increase to the cost cap or change in the schedule milestones subject to the recommendation of the SEC Science Director and approval of the SSE AA. Approved changes will be reflected in modifications to the PCA and the STP Program Plan as appropriate.

Any proposed changes to the approved POP budgets for the STP Program will require a written change request and impact statement for approval by the SEC Science Director.

5.2. Education and Public Outreach

An education and public outreach (E&PO) program shall be an integral element of the STP Program. Every STP Project shall devote adequate resources to the planning and implementation of such an effort. In accord with the policies outlined in *Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy (October 1996)*, 1-2% of the total project budget shall be allocated to education and outreach. Activities shall include public information (i.e., outreach) programs that will inform the public through mass media or other means, or utilize other innovative ideas for bringing space science to the public. The Project Managers shall document, in the Confirmation Assessment data package, the project's approach for planning an education/outreach program, arranging for appropriate partners and alliances, implementing the education and public outreach program (including appropriate evaluation activities), and planning for the dissemination of education/outreach products and materials. Costs for such activities shall be phased as a part of project planning development, and operations costs.

5.3. Environmental

All STP Projects shall conform to NASA and US environmental requirements for mishaps, orbital debris, radiation sources and other environmental concerns.

5.4. Mission Success Criteria

The mission full success and minimum success criteria are developed during Phase A and updated pre-launch by the STP Program Executive in coordination with the Program Manager, the SEC Science Director, the Program Scientist, the Project Manager, and others as appropriate. The final mission success criteria is documented and signed prelaunch by the Program Executive, SEC Science Director, Flight Program Division Director, and the AA for SSE.

6.0 Program Schedule

6.1. Program Master Schedule

The STP Program Office shall develop and maintain the STP Program Master Schedule (PMS). The PMS shall contain all of the milestones in the PCA and will be updated as more detailed definitions of each project's plans are developed. The PMS will include as a minimum, but is not limited to:

- Instrument AO Issuance Dates and Selection Dates
- Major Project Reviews
- Project Confirmation Dates
- Instrument Delivery Dates
- Launch Dates

6.2. Schedule Control

All changes to the PMS shall be reviewed and approved explicitly via document change request procedures to the STP Program Configuration Management (CM) Plan. Every project will be required to

have a master schedule, which includes the Formulation Phase and the schedule for Implementation (including Operations). The project schedule shall be first established at the start of formulation, updated annually concurrent with the POP, and baselined at project approval (final confirmation).

All schedule changes and impacts are integrated into the resources requirements. As changes occur, the life-cycle costs of the project(s) and contingencies are updated including all programmatic impacts both internal and external to the STP Program Office.

When the proposed revised schedule violates the PCA, the revised schedule can only be adopted if a change to the PCA is subsequently approved by the AA for SSE and the Office of the NASA Administrator. The Program Manager can authorize changes to the Program Master Schedule if changes are demonstrated to be compliant with PCA milestones.

7.0 Cost Management

7.1. Budget

The Budget for the STP program is approved annually during the POP review cycle. The most current approved budget for the STP program shall be documented in the PCA.

7.2. Life Cycle Costing

The Program shall implement life cycle costing when assessing the impacts of changing the Program or Project content. All records of the life cycle costing will be placed under configuration control for the STP Program and Projects.

8.0 Controls

The STP Program has established specific requirements to assure that the Program and Projects are validated against specific OSS requirements. Of special importance are the STP Program Performance Indicators and Reserves.

8.1. Program Level

During Project formulation, two independent confirmation assessment reviews are required (for moving from Phase A to B and from Phase B to C). The OSS, through the STP Program Executive, is responsible for initiating and coordinating these independent assessments during project formulation. During implementation, an independent mission readiness assessment will also be conducted prior to launch. The GSFC and STP Program Manager are responsible for initiating this review. Annual reviews will be conducted coincident with the STP Program's annual Program Operating Plan (POP) preparation and approval. The annual POP review shall include assessments of all aspects of each STP project in Formulation or Implementation.

Schedule milestones, technical performance indicators, and costs caps for each project shall be implemented and baselined at project approval. Refer to Section 5.1.2 with respect to control of changes to these major parameters. The Program Manager, GSFC Center Director (as chair of the GPMC), and SSE AA shall approve changes to this STP Program Plan and the Program Level Requirements Appendices. The STP Program Office shall administer configuration management of this document.

8.2. Project Level

The key STP Project requirements are the PLR's as documented in Appendix A of this document. The Program Office regularly reviews each project’s status and projected ability to meet its requirements. If at any time the project appears likely to not meet its program level requirements, it is subject to a special review, and possible cancellation by the SSE AA (as discussed in Section 5.1.2).

Each Project in Implementation will be controlled to the requirements identified in the respective Project Plan, this Program Plan, and the PLR's. The STP Program Manager and the respective Project Manager shall approve changes to the Project Plan. Only the SSE AA, following the recommendations and approvals of the STP Program Manager, GSFC PMC, and SEC Science Director - can approve changes in PLR's, including any science investigation descopes or technical performance reductions.

Each Project shall demonstrate adequate levels of schedule reserve and cost contingency throughout formulation and implementation. Contingency should be calculated as a function of the estimated remaining schedule and cost to complete. The amount of schedule reserve and cost contingency

should be commensurate with the level of risk in the project. Project managers shall define their reserve policy (i.e., a reserve depletion schedule) for their respective project. Their project manager's anticipated methodology of reserve creation, budgeting, and allocation shall be described in their project plans. Reserves should be adequate to cover contingencies (unknown and unanticipated problems) as well as reserve allocation to cover project risks, schedule delays (internal causes), and spares.

8.3. Reviews

Reviews shall be defined in the respective Project Plans that identify key gates where consent to proceed must be granted by the SSE AA, the SEC Science Director, the GSFC PMC, or the STP Program Manager. Mandatory Formulation Reviews are Confirmation Assessments (CA's) and Confirmation Reviews (CR's), both being required for transition from Phase A to B and from Phase B to C. Each STP Project is verified for compliance with STP Program requirements by independent review during the Phase A to Phase B CA and the Phase B to Phase C CA.

The first CA, coordinated by the Program Executive and Program Manager, occurs at the end of Phase A. Results are first presented to the STP Program Office and Program Executive. If the project is approved to proceed into Phase B, then an initial CR is scheduled with the SSE AA. Authority to proceed into the remainder of project formulation (Phase B) is based on the results of the CA and SSE AA approval.

If the NASA PMC chooses to elevate the STP program or one of its projects (e.g. STEREO) to itself as the governing PMC, the Program or Project would be subject to a Non-Advocate Review (NAR) in lieu of the Phase B to C Confirmation Review, and yearly IAR's during Implementation.
Another CR is conducted at the end of project formulation. The Program Executive, in coordination with the STP Program Office, charters a CA. Results are first presented to the STP Program Office and Program Executive. If the project is approved to proceed into Phase C, then a Confirmation Readiness Review (CRR) is scheduled with the GSFC PMC. The CA chairman will present the findings and recommendations from the CA to the GSFC PMC CRR. If the GPMC recommends proceeding to implementation, then the Program Executive coordinates a final CR with the SSE AA. Prior to the CR, pre-briefings to the Deputy AA by the project and the CA chair are held.

The responsibilities for all preparation meetings and the final CR process are defined in **Table 3**. Each project's data package for proceeding into Implementation shall include as a minimum, the Project Plan (must contain all the elements described in NPG 7120.5A, Appendix E.4), Program Plan Appendix (identifying unique program level requirements on the project), and a Risk Management Plan.

Each mission is reviewed for flight readiness about 6 weeks before launch. The Mission Readiness Review (MRR) for STP Projects is held by the GSFC PMC and based on the results of that review, the project is certified for flight readiness by the GSFC Center Director to the AA for SSE.

CONFIRMATION REVIEW and PREPARATORY REVIEWS	
Confirmation Assessment (CA) Organized By:	**STP Program Executive**
CA Presented To:	STP Program Office and Program Executive
CA Review Panel Chairman Selected By:	STP Program Executive
CA Chairman:	Non-NASA Employee
Confirmation Readiness Review (CRR) Organized By:	**Respective Project Manager**
CRR Presented By:	CA Chairman, Project Manager
CRR Presented To:	Respective PMC
CRR Chairman Selected By:	Respective PMC
Confirmation Review (CR) Organized By:	**STP Program Executive**
CR Presentation By:	Project Manager, CRR Chairman
CR Presented To:	SSE AA
Authority to Proceed into Implementation granted by:	SSE AA

Table 3 Confirmation Review Attributes

9.0 Relationships to other Programs and Agreements

When a non-NASA government organization is selected as part of a mission team, an agreement will be prepared between the STP Program Office and the organization and finalized before initiating mission implementation. Appropriate agreements will also be prepared between the STP Program and other non-NASA organizations to document other support for the mission. Agreements with international Partners will be prepared and finalized by Headquarters OSS at project approval.

9.1. Launch Vehicles

The STP Program encourages a wide variety of methods for access to space. Expendable launch vehicles (ELV's), space shuttle payloads, spacecraft from other programs, and suborbital flights are all encouraged as ways to increase the program flexibility and maximize flight opportunities for space science. OSS provides ELV and launch services funding as part of the STP Program Budget and Project sub-allocations.

NASA-procured ELV launch services are typically included for all project classes. Kennedy Space Center (KSC) has been designated as the lead center for the acquisition and management of ELV launch services. As the performing center, KSC is provided the budgeted funds to support the approved STP Program launch schedule from OSS. These funds are part of the total cost cap for each project.

9.2. Space Operations Management Office (SOMO)

Johnson Space Center (JSC) has been designated as the Space Operations Lead Center and has established the Space Operations Management Office (SOMO), which oversees and manages all Agency wide space operations and systems. This includes the worldwide space and ground networks, mission and network control functions, data processing and planning systems, and telecommunications systems. The requirements and interfaces between the STP Program and SOMO are defined on a project unique basis. SOMO shall provide budgeted funds to support ground system development for the STP Projects per the STP Program Master Schedule. As part of the overall project cost cap, these funds also may be used for other elements of the mission, as determined by the Project Manager.

9.3. LaRC Space Science Support Office (SSSO)

The Space Science Support Office (SSSO) at Langley Research Center (LaRC) shall be responsible to OSS for managing the AO process including preparation, release, and performance of technical/management/cost evaluation. OSS shall perform science evaluation and final selection. This office shall also provide support for various reviews independent evaluations, and conferences as required by the STP Program Office or OSS. The SSSO may also perform confirmation assessments for specific projects in response to OSS requests.

10.0 Acquisition Strategy

The STP Projects are “community defined” and documented in the SEC Science roadmap. Once formulation is authorized by OSS, the STP Program Office is delegated the responsibility for Formulation Support and Implementation which is initiated with the establishment of a unique STP Project Office. The STP Program will use broadly announced competitive procurements and partnerships to the greatest extent possible. The STP Program will promote and encourage participation by universities, industry, other government agencies, and small, disadvantaged businesses in all procurements.

10.1. Announcement of Opportunity Process

NASA Headquarters shall procure scientific investigations (instruments) through the Announcement of Opportunity (AO) process managed with support from the STP Program Office and SSSO at LaRC. The Headquarters will issue an AO to solicit instruments for a mission prior to the start of mission formulation. The announcement of the awards from the peer reviewed instrument proposals coincides with the start of the mission formulation. Mission studies solicited during formulation shall use competitive procurements.

10.2. NASA Research Announcements (NRA's)

Technology development selections shall be via AO's, NASA Research Announcements (NRA), or unsolicited proposals.

10.3. Requests for Proposals

A Project Implementation Team (PIT) [e.g., the spacecraft implementer or provider] shall be selected by an RFP process and shall execute the Project Implementation. There shall be open competitions for projects that require a provider of a spacecraft or project integrator.
The PIT may be from any category of U.S. or non-U.S. organizations, including educational institutions, industry or nonprofit institutions, or from one of the NASA Centers, the Jet Propulsion Laboratory (JPL), other federally funded research and development centers, or other U.S. Government agencies. The PIT may be formed from any combination of these institutions. The RFP selection of a PIT provides the full authority necessary to contract with all members of that team without further competition.

11.0 Commercialization Opportunities

Due to their state-of-the-art nature, there are commercialization opportunities that may be exploited by organizations developing new instrumentation technology for STP Projects. The STP Program Office will coordinate with the Technology Transfer Office at NASA GSFC to assure that communication of new technology endeavors are fully publicized and partnering opportunities communicated to the commercial sector. The STP Project Managers and their respective PIT will be regularly encouraged to commercialize any new technology items associated with their Projects.

12.0 Technology Assessment

The technology thrusts that will be utilized by the STP Projects are all mission-unique. The Program Office provides technology maturation information to potential projects and supports the maturation of new technologies that can be beneficial to upcoming STP Projects.

13.0 Data Management

STP Project investigation teams will be responsible for initial analysis of the data, their subsequent delivery to an appropriate data repository, the publication of scientific findings, and communication of the results to the public.

In accordance with NASA policy, data are to be released as soon as possible after a brief validation period appropriate for each project. There is no proprietary period for science teams for exclusive use of the data for scientific analysis. Each STP Project shall prepare a Science Data Management Plan for approval by the Headquarters Program Scientists and GSFC Lead Scientists.

Each STP Project shall be responsible for collecting the scientific, engineering, and ancillary information necessary to validate and calibrate the scientific data prior to delivery to the appropriate science data archive center for dissemination. These may include the Solar Data Analysis Center at the

Goddard Space Flight Center (GSFC); the High Energy Astrophysics Science Archive Research Center at GSFC; the Optical/UV Science Archive Research Center at the Space Telescope Science Institute; the Infrared Science Archive Research Center at the Jet Propulsion Laboratory; and the National Space Science Data Center at GSFC. The time required to complete this process shall be specified in the Science Data Management Plan and should be the minimum necessary to provide appropriate data to the scientific community and the general public, but not longer than six months. The interface requirements, data formats, and other standards for delivery of data products shall be coordinated with the appropriate science data archive center and documented in the Project Plan.

14.0 Risk Management

Project managers shall use continuous risk management processes for identifying, analyzing, mitigating, monitoring, and tracking risks throughout the project life cycle. Risk is anything that threatens mission success, including safety, cost, schedule, and technical risks. Project decisions, including decisions on the depth of safety and mission success analysis, shall be made based on an orderly risk management process.

Since each project is independent and unique, the risk management approach will be tailored so that it fits the unique needs of the individual project. Several tools for this purpose which may be used include Failure Modes and Effects Analysis, Fault Tree Analysis, and Probabilistic Risk Assessments. The primary risk management tools for STP Projects are schedule and financial reserves, modification of technical performance, as well as descoping of mission requirements above the minimum science requirements.

Each STP Project shall have an ISO compliant Risk Management Plan, tailored specifically for its Project. The Risk Management Plan will cover cost, schedule and technical risks, including their identification, tracking, and mitigation activities. Each Project's Risk Management Plan shall be developed during Formulation, presented at the Confirmation Review, and updated (if necessary) during Implementation. The respective Project Managers shall select one or more risk management tools [1] and document their application to the project. Each Risk Management Plan shall document a continuous risk management process starting in Formulation and continuing through to the end of the mission.

Each Project shall prepare a Top Ten[2] Risk Watch List to summarize their major risks for the STP Program Office. Each STP Project shall report the status of these top ten risks (ranking based upon their probability of occurrence and/or impact/severity if they occur) to the STP Program Office on a regular basis (e.g., during their weekly or monthly Project Reviews). Information shall include status of mitigation activities for each risk. The Watch List shall be updated to reflect newly identified risks, assessment ranking assessment-ranking changes, and status of the respective mitigation plans.

15.0 Logistics

Logistics requirements are project-unique and shall be addressed in the Project Plan for each STP Project.

16.0 Test and Verification

Test and verification requirements are project-unique and shall be addressed in the Project Plan for each STP Project. All projects shall employ software Verification and Validation (V&V) techniques for risk mitigation. Each project is required to produce and document a plan that addresses the performance of V&V over the life cycle of the software design and development. The performance of Independent V&V (IV&V) on software shall be performed where appropriate and should be based on the cost, size, complexity, life span, risk, and consequences of failure. The NASA Software IV&V facility in Fairmont, WV must either provide the IV&V or an assessment and approval of the projects IV&V plans.

---

[1] Refer to NASA Reference Publication 1538, "System Engineering Tool Box for Design-Oriented Engineers", for a list and brief description of some of the available tools.

[2] Top Ten is an estimate of the major risks for each project. The actual tracked and discussed risks at the respective reviews shall be dependent on the individual project.

17.0 System Safety and Mission Assurance

All STP Projects shall be developed and operated within the framework of the NASA and respective NASA Center's GSFC ISO 9000 quality management system. The mission assurance requirements will be tailored to each project as specified in the project plan. Each project shall implement a system safety program that meets the requirements of the launch vehicle provider, all hardware-processing sites, and launch site.

18.0 National Environmental Policy Act Compliance

The STP Program shall have an approved Environment Impact Statement (EIS). The EIS establishes boundaries for applications to projects and conforms to the National Environmental Policy Act. New projects must either fit within the boundaries of the Program EIS or a new project specific EIS will be developed. The STP Program Manager will review and recommend to the STP Program Executive if a new project specific EIS is required. The STP Program Executive coordinates the content of the recommendation with the Office of External Relations (Code I) and leads the Enterprise coordination of the EIS for the STP Program, unless the NASA PMC decides to elevate the governing PMC level.

19.0 Reviews

19.1. Program Reviews

Because the STP Program is an existing program reporting to the GSFC as the governing PMC, the periodic management reporting and annual budgetary process already in place provides adequate program evaluation. Therefore, no program NAR or independent annual reviews are necessary for the STP Program.

19.2. Project Reviews

The review and reporting requirements will vary from project to project depending on the complexity, visibility, and other programmatic considerations. The following are examples of the types of reviews that may be conducted for a given project:

- Concept Review
- Mission Definition Review (MDR)
- System Requirements Review (SRR)
- Independent Assessment (IA)
- Confirmation Assessment (CA)
- Confirmation Readiness Review (CRR)
- Confirmation Review (CR)
- Preliminary Design Review (PDR)
- Subsystem Peer Reviews
- Critical Design Review (CDR)
- Pre-Environmental Review (PER)
- Pre-Ship Review (PSR)
- Flight Readiness Review (FRR)
- Operational Readiness Review (ORR)
- Mission Operations Review (MOR)
- Mission Readiness Review (MRR)
- Launch Readiness Review (LRR)

The minimum set of NASA held reviews for each mission is the Phase A to Phase B CA and initial Confirmation Review; the Phase B to Phase C CA, CRR, and CR; the MRR; and all reviews associated with the launch vehicle or launch site. All other reviews are defined and implemented if required by the Project Manager and documented in the respective Project Plan. A review team that is independent of the team being reviewed shall conduct all reviews. The Program Office shall participate in all project reviews. OSS shall be invited to participate in all Project Reviews.

20.0 Tailoring

The STP Program has tailored its approach to meeting the requirements of NPG 7120.5A, NASA Program and Project Management Processes and Requirements. The word "mission" is used interchangeably with project and implies that the project has science as its primary objective. The TIMED mission, the first mission in the STP Program, initiated its implementation prior to the taking effect of NPG 7120.5A as the management standard. Requirements imposed by NPG 7120.5A and required in the TIMED schedule before the date of the imposition of NPG 7120.5A as the management standard are waived for the TIMED mission.

The STP Program divides the Formulation Phase of each mission into two or more segments. Positive results of reviews are required to advance to succeeding segments. A mission Confirmation Assessment and a Headquarters Confirmation Review and approval of the assessment results confirms the Headquarters' commitment to move into the Implementation Phase and is conducted instead of a Non-Advocate Review.

Methods that provide the equivalent content to Earned Value Management are used to assess technical, cost, and schedule parameters during mission and Program execution. The STP Program distributes information from science, engineering, and technical management as openly and as rapidly as allowed by Export Administration Regulations and International Traffic in Arms Regulations. It makes a commitment to continuous learning and competence in mission and program management by permitting substitutions of required courses for experience and by holding program and mission managers' line supervisors accountable for annual training requirements.

21.0 Acronym List

AA	Associate Administrator
AETD	Applied Engineering and Technology Directorate
AO	Announcement of Opportunity
APA	Allowance for Programmatic Adjustment
APL	Applied Physics Laboratory
CDR	Critical Design Review
CM	Configuration Management
CME	Coronal Mass Ejection
ELV	Expendable Launch Vehicle
E&PO	Education and Public Outreach
FAR	NASA Federal Acquisition Regulations
FPPD	Flight Programs and Projects Directorate
FRR	Flight Readiness Review
FY	Fiscal Year
GEC	Global Electrodynamics Connections
GFE	Government Furnished Equipment
GPMC	Governing Program Management Council
GSFC	Goddard Space Flight Center
IAR	Independent Annual Review
ISAS	Institute of Space and Astronautical Science
ISTP	International Solar Terrestrial Project
JHU	Johns Hopkins University
JPL	Jet Propulsion Laboratory
JSC	Johnson Space Center
KSC	Kennedy Space Center
LaRC	Langley Research Center
LRR	Launch Readiness Review
LS	Lead Scientist
MIDEX	Medium-class Explorers

MC	Magnetospheric Constellation
MMS	Magnetospheric MultiScale
MO&DA	Mission Operations and Data Analysis
MOR	Mission Operations Review
MRR	Mission Readiness Review
NAR	Non Advocate Review
NEPA	National Environmental Protection Agency
NPG	NASA Procedures and Guidelines
NRAs	NASA Research Announcements
ORR	Operational Readiness Review
OSS	NASA Headquarters Office of Space Science
PCA	Program Commitment Agreement
PDR	Preliminary Design Review
PER	Pre-Environmental Review
PIT	Project Implementation Team
PLR	Project Level-1 Requirements
PMC	Program Management Council
POP	Program Operating Plan
PSR	Pre-Ship Review
RFP	Request for Proposal
SEC	Sun Earth Connection
SMEX	Small Explorer
SOHO	Solar and Heliospheric Observer
SOMO	Space Operations Management Office
SRR	System Requirements Review
SSE	Space Science Enterprise
SSSO	LaRC Space Science Support Office
STAAC	GSFC Systems Technology And Advance Concepts
STEREO	Solar Terrestrial Relations Observatory
STP	Solar Terrestrial Probes
SUNBEAMS	Students United with NASA Becoming Enthusiastic About Math and Science
TIMED	Thermosphere – Ionosphere – Mesosphere Energetics and Dynamics
UCB	University of California, Berkley
UK	United Kingdom
USA	United States of America

Appendix A: Project Level Requirements

The STP Program Office has accepted the following Project Level Requirements (PLRs).

1. Thermosphere, Ionosphere, Mesosphere Energetics and Dynamic Mission (TIMED) Level 1 Requirements Definition (460-RQMT-0004)
2. Program-Level Requirements for the Solar-B Project (460-RQMT-0018)

As additional projects approve their PLRs, the respective requirements will be incorporated herein.

Appendix B. Definitions for the STP Program

Term	*Definition for STP Program*
Extended Mission	The on-orbit period of performance of a project that occurs after the prime mission.
Fully Successful Requirements	The mission, if full implemented, will accomplish the entire set of objectives identified at time of project approval.
Minimum Success Requirements	The minimum success criteria science component below which the Project will not be considered justifiable successful for the proposed cost.
Mission	The overall scientific goal(s) and objective(s) of an STP Project and summarizes the science justification for which the Project was conceptualized and authorized by NASA OSS.
Prime Mission	The on-orbit period of performance for a specific project to meet baseline science objective(s).
Project Implementation Team (PIT)	The team of companies / personnel whom are selected via RFP evaluation to perform the Implementation efforts. This may or may not include development of the instruments.
Project Manager	The manager to whom the Program Manager delegates the responsibilities of an STP Project Implementation. A project Manager may also be assigned Formulation responsibilities. .
STP Program	The summation of all Formulation and Implementation activities to achieve the goals and objectives identified in the STP Program Commitment Agreement (PCA).
STP Project	A significant activity – required under the STP SEC roadmap - which has defined scientific goals, objectives and requirements, life-cycle-costs (LCC), and a defined beginning and an end (launch and the subsequent on-orbit checkout and operations). A Project is established as soon as NASA Headquarters Office of Space Sciences, hereafter referred to as OSS, issues a letter - to the STP Program Office - to authorize the project to begin formulation the STP Program Office. An STP Project Manager who reports programmatically to the STP Program Manager shall manage the STP Project.